

29. On Two New Species of Tapeworms from the Stomach and Small Intestine of a Wallaby, *Lagorchestes conspicillatus*, from Hermite Island, Monte Bello Islands. By R. C. LEWIS, M.A. (Cape), (1851 Exhibition Scholar) *.

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I am indebted to Mr. P. D. Montague, Caius College, Cambridge, for this material obtained by him on the recent expedition to the Monte Bello Islands. The parasites come from the intestine and stomach of a species of Wallaby, *Lagorchestes conspicillatus*, found only on two or three of the Monte Bello Islands. The specimens were compared with those in the collection at the Berlin Museum, thanks to the courtesy of Dr. A. Collin, who kindly assisted in comparing these species with those in the Museum, including Rudolphi's collection. A comparison was also made with the collection in the British Museum (Natural History), where *Cittotænia pectinata* Goeze (21 & 25) and *Cittotænia denticulata* Rudolphi (21) were examined, and no specimens bearing any resemblance to the species under discussion were seen in the collection at the Zoological Gardens or at the London School of Tropical Medicine.

Both species are characterized by the presence of two sets of genital glands and two lateral genital pores to each segment. The genital canals cross the longitudinal canals and nerves dorsally. Interproglottidal glands are absent, and there are no calcareous bodies. They belong to the genus *Cittotænia* Riehm. The history of the genus is of some interest, and is discussed by Stiles and Hassall (26) and by Lyman (21). Riehm (23 & 24) established the genus in 1881, but later rejected it, placing his type *Cittotænia latissima* Riehm in the genus *Dipylidium* Leuck. In 1891 Blanchard included double pored leporine cestodes in the genus *Moniezia*, taking *Tænia expansa* Rudolphi as his type. Later, 1893, Railliet included these forms in the genus *Ctenotænia* with *Tænia marmotæ* Frolich as type. It was not until 1896 that the genus *Cittotænia* was re-established by Stiles and Hassall with the following characteristics:—Anoplocephaline cestodes with segments broader than long and longer than thick, end segments in some cases becoming longer and narrower. Two full sets of genital glands and two lateral genital pores to each segment; generally

* Communicated by Prof. E. W. MACBRIDE, F.R.S., V.P.Z.S.

† For explanation of the Plates see pp. 431-433.

one, sometimes two, simple transverse tubular uteri in each segment, uterus generally with proximal and distal diverticula. Vagina ventral to cirrus-pouch on both sides of segment. Dorsal canal usually between ventral canal and nerve. Genital canals cross longitudinal canals and nerves dorsally. Interproglottidal glands absent. Calcareous bodies not yet recorded. Eggs with well-developed pyriform bodies, the horns of which are long and filamentous, crossing each other. Riehm based his diagnosis on the noteworthy spread of the excretory system, which is not ladder-like, but consists of three to five chief side stems and numerous net-forming branches; on the double reproductive organs, which open on the projecting lateral borders of the segments; and on the head appearing pushed-in in front and hookless.

Blanchard's diagnosis of the genus *Moniezia* differs from that of *Cittotænia* in that on the right side the vagina is ventral to the cirrus-pouch and on the left side dorsal. Interproglottidal glands present, and the horns of the pyriform body do not cross, and end in a disk. The genus *Thysanosoma*, founded by Diesing, 1835, contains double pored cestodes very similar to those included in the genus *Cittotænia*, but differs in that the genital canals cross the ventral canals and nerve dorsally and the horns of the pyriform body are absent. There is one transverse undulating uterus, and forms with one set of genital glands and one genital pore are also included. Stiles states that from the analysis of characters *Cittotænia* forms a genus intermediate between *Moniezia* and *Thysanosoma*. The first of the species now to be described was at first thought to belong to the genus *Thysanosoma* Dies., resembling most closely *Thysanosoma fimbriata* Dies., but it was found that the genital canals cross the excretory canal and nerve dorsally, and that the species shows considerable resemblance to *Cittotænia zschorkei* von Janicki (10) and agrees with this species in the absence of the pyriform body. Von Janicki therefore holds that the generic diagnosis of the genus *Cittotænia* should be altered from pyriform body present to pyriform body present or absent. Von Linstow in his description of *Cittotænia quadrata* (20) describes and figures the vagina running out and opening dorsal to the cirrus-pouch, and does not state that this is contrary to the normal occurrence in the genus. It is evident from the large number of synonyms for each species, and from the departure from the generic characteristics in some of the original descriptions, that the genus *Cittotænia* requires revision. The two species from the Wallaby show the generic characteristics as described for the genus *Cittotænia* by Stiles and Hassall (26) and are therefore included in that genus.

CITTOTÆNIA LAGORCHESTIS, sp. n. (Pls. I.-IV.; V. figs. 14, 15; VI. figs. 17, 18.)

The specimens vary in length from 40-60 mm. and the greatest breadth is 4 mm. There are usually about 150 proglottides.

The strobila are uniform in breadth save at the anterior and posterior extremities, where they become narrower. The scolex is .6 mm. long by .75 mm. broad. The proportion of breadth to length in young segments is as 1 to 3, in older as 1 to 6. The scolex is rounded with no rostellum and no hooks. It is set on the top of the strobila like a dome-shaped knob. There are four oval suckers. Each of the four is .35 mm. long by .25 mm. broad. There is no neck, and the proglottides commence immediately behind the head (figs. 2 & 3); each of them possesses a well-marked projection at its hinder border which overlaps half of the succeeding proglottis. The edges of these projections are fimbriated, showing an even serration which gives the animal an ornamented appearance resembling the condition found in *Thysanosoma fimbriata* Dies. (22). The genital pores are found in the middle of the projecting lateral margins of the segment. The cirri are often seen projecting from the pores (figs. 12 & 14). The musculature does not present any marked peculiarities. It is like the structure described for *Cittotenia zschorkei* von Janicki (10), where the musculature forms numerous fine-threaded bundles. The subcuticular layer consists of well-developed longitudinal and transverse muscular layers. There is also a system of sagittal fibres which run dorso-ventrally, forming a dense network of fibres between the transverse plates. They branch greatly and these branches form a network around the testes and various female glands. There is a ventral and a dorsal longitudinal excretory canal on each side. The ventral canal is large, thin-walled, and seldom circular in cross-section. The dorsal canal is smaller and circular. It has a thick cuticular lining around which is a layer of muscle-fibres. All the canals unite in the head, forming an anterior loop between the suckers. The ventral canals are connected in the posterior portion of each proglottis by a transverse canal. There are no secondary longitudinal canals connecting the transverse canal as described for *C. pectinata* Goeze. The excretory system so far resembles that in *C. variabilis* Stiles (21). On the terminal segment the canals open by a simple pore situated towards the anterior end of the proglottis (fig. 15). The large ventral canal discharges by simple transverse tubes into this pore. There is no reservoir as described for *C. pectinata* Goeze (21), nor is there a projection of the parenchyma into the ventral canal at the posterior end of each segment, as described by Fuhrmann in *C. kuvaria* Shipley (7). The first rudiments of the genital organs appear in the proglottides immediately behind the head (fig. 3). There are two sets of genital glands in each segment (fig. 7), and two uteri in the early segments up to the 80th segment, where they meet in the median field, and it appears as if there were only one uterus (fig. 1). The uteri possess proximal and distal diverticula. Very young segments in which the reproductive organs are in their first rudiments, show the vagina running out to open into the genital atrium posterior to the cirrus (figs. 5 & 6).

The vagina is a thick-walled tube with a narrow lumen. It is connected with a very large receptaculum seminis. With increasing age, before the ovary is functional, the vagina atrophies from the pore inwards, and finally, when female and male canals are fully developed, the vagina remains only as a small tubular projection from the receptaculum (figs. 9 & 11). This resembles the condition found in *C. zschokkei* von Janicki (10), and von Janicki concludes that the young proglottides, whose testes are not yet developed, function as females, and that the older proglottides with abortive vaginae function as males, although the female organs are otherwise fully developed. The eggs must all be fertilized by the sperm stored up in the receptaculum seminis, which receives sperm through the vagina from the same worm or from another worm by copulation in the young state, and this is proved by the fact that the receptaculum of proglottides in which testes are not yet developed are filled with spermatozoa.

Male Reproductive Organs.

The first rudiments of the testes are seen about the 12th segment. They reach maturity about the 60th segment, and are seen as small rounded sacs lying in the dorsal field of each segment between the transverse excretory canal of the preceding segment and the cirrus-sac (figs. 7 & 11). They do not extend in towards the median field as in *C. kuvaria* Shipley (7), but are confined to the dorsal region between the ventral excretory canal and the inner termination of the cirrus-sac. From these testicular sacs, about 50 on each side, little ducts are given off which connect with the vas deferens. The vas deferens is a slender duct which runs in towards the median field and then loops back above the receptaculum seminis to run obliquely down to the cirrus-pouch. The vas deferens does not extend further towards the median field than the inner extremity of the receptaculum seminis. Before entering the cirrus-pouch there is a circular swelling, the vesicula seminalis, with a diameter of 1 mm. and a thick wall. The cirrus-pouch is elongated and of uniform size and thickness in mature segments, 1 mm. long by 2 mm. broad (figs. 9 & 11). It has muscular walls consisting of an outer longitudinal layer and an inner thicker circular layer. The cirrus also has circular and longitudinal fibres. The space between the muscular wall of cirrus-sac and cirrus is filled with spongy tissue. The cirrus is thick-walled with a narrow lumen. It is often seen protruding to a great extent, nearly as far as the length of the cirrus-pouch. It is covered externally with closely set bristles. The outer end of the cirrus-sac discharges into a space, the genital atrium. Its outer end is guarded by a circular muscular sheath, the sphincter; and beyond this sheath, in the genital atrium, is a circular projection of the floor of the latter.

Testes are not observed after the 100th segment, though the cirrus-sac persists to within twelve segments of the posterior

extremity. In this respect this species differs from *C. pectinata*, where the testes are described as persisting to the last proglottis.

It is noteworthy that in this species at the tapering posterior extremity no genital glands are observed in the last 12-15 segments (figs. 13 & 15).

Female Reproductive Organs.

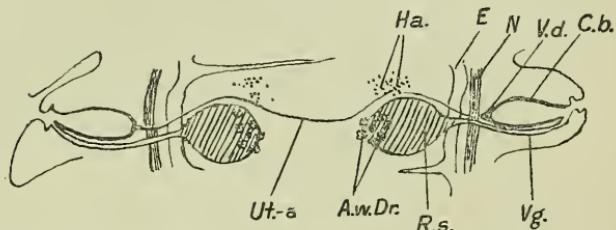
These appear earlier than those of the male. The first rudiments of the genital glands are found in the segments immediately behind the head (fig. 3). The vagina opens to the exterior up to the 25th segment, but after that aborts from without inwards. The receptaculum is prominent from the first and persists throughout the strobila, except in the last 12-15 segments where, as already mentioned, no genital glands are observed. The ovary is rudimentary up to about the 40th segment, where it takes on its mature form, and at about the 50th segment the first traces of the uteri are seen. After the 100th segment all of the female organs except the uterus begin to atrophy, and in the posterior segments only the uterus and receptaculum seminis persist (figs. 12 & 14). The vagina, only complete in the early segments, runs out ventral to the cirrus-pouch and opens into the genital atrium posterior to cirrus (fig. 6). At its distal end the lumen is very small and the cuticular lining very thick. In the region beneath the cirrus-pouch it is surrounded by deeply staining cells as in *C. variabilis* Stiles (21), and in this region has numerous bristles on its walls. It is a straight tube, and runs in to open into the large receptaculum seminis. The receptaculum seminis is elongate, .2 mm. long by .1 mm. broad. It is surrounded by a thin layer of circular muscle-fibres, and outside the fibres is a single layer of cells which stain deeply. The ovary consists of a number of "Indian club" shaped pouches. Each pouch opens into a common reservoir by a narrow neck (fig. 10). The oviduct runs from the reservoir of the ovary towards the yolk-gland. Beyond the opening of the vitelline duct into the oviduct, the latter passes through the shell-gland and enters the uterus at a spot situated just below the ovary. The ovary is situated dorsal to the receptaculum. Its outer tubules overlap the receptaculum, but the inner tubules are slightly nearer the median field. Ventral to the ovary and near the posterior margin of the segment is the small vitelline gland. Alongside it, towards the median field, is the comparatively large shell-gland (fig. 11). The duct from the receptaculum seminis opens into the reservoir of the ovary at the side nearer the margin.

The uterus is formed dorsal to the ovary. The female genitalia are crowded close together. The uteri, at first separate, gradually extend towards the median field, and their blind ends become closely applied, so that in older segments it is difficult to distinguish two uteri. The uterus does not cross the longitudinal canals and nerves, but in older segments pushes them nearer the margin.

margin. It is possessed of numerous proximal and distal diverticula. As already mentioned, the egg possesses no pyriform body.

The nervous system has not been worked out, as the specimens were fixed in alcohol, but from the sections it appears that the condition is like that in *C. quadrata* von Linstow (20), with a single trunk on each side to the outside of and dorsal to the two excretory canals, and a ganglionic mass is observed beneath the loop formed by the excretory canals in the head.

Text-figure 1.



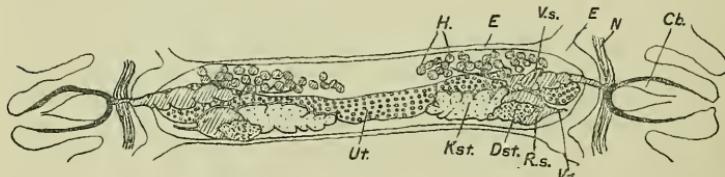
C. zschokkei von Janicki. Young already fertilized proglottis in optical section, from von Janicki (10), p. 130. $\times 45$.

A.w.Dr., rudiments of female genital ducts; *C.b.*, cirrus-pouch; *E*, excretory vessel; *Ha.*, rudiments of testes; *N*, longitudinal nerve; *R.s.*, receptaculum seminis; *U.t.a.*, rudiments of uterus; *V.d.*, vas deferens; *V.g.*, vagina.

Affinities and Contrasts with other Species.

In describing this species it has already been pointed out that of all the species of *Cittotenia* this one resembles most closely *C. zschokkei* von Janicki (10). The chief points of resemblance are the possession by both species of a projecting sheath, which is

Text-figure 2.



C. zschokkei von Janicki (10). p. 130. Ripe proglottis in optical section. $\times 45$.
Dst., vitelline gland; *H.*, testes; *Kst.*, ovary; *U.t.*, uterus; *V.s.*, vesicula seminalis.
Other lettering as in text-fig. 1.

fimbriated, at the posterior border of each segment overlapping half the next segment: also the development and position of the reproductive organs; the absence of the pyriform body in

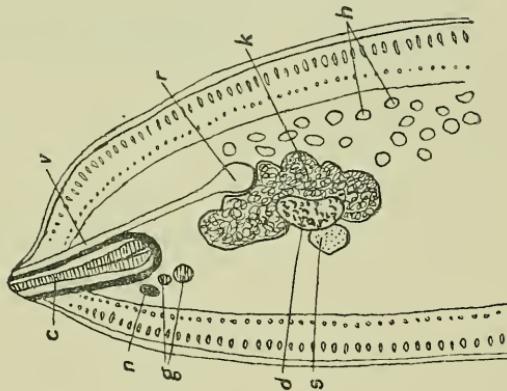
the egg; the large receptaculum seminis, and the vagina aborting in later segments. There are, however, important points of difference which mark *C. lagorchestis* as a distinct species. In the first place, there are only two longitudinal excretory canals and one transverse excretory canal in each segment in *C. lagorchestis*, whereas in *C. zschokkei* there are three longitudinal excretory canals and two transverse canals to each segment. The most important contrasts are found in the reproductive organs, and may be tabulated as follows:—

<i>C. lagorchestis.</i>	<i>C. zschokkei.</i>
(1) Vas deferens a slender tube with an oval swelling, the vesicula seminalis, near entrance into cirrus-sac. Vas deferens recurses to receive ducts from testes.	Vas deferens much swollen throughout its length to form an elongate vesicula seminalis. Vas deferens passes straight to testes.
(2) Cirrus-pouch extends across the longitudinal canals and nerve towards the median field for half its length.	Cirrus-pouch does not extend inwards over excretory canals and nerve.
(3) Testes situated dorsal to projection of cirrus-pouch in inner parenchyma between ventral longitudinal excretory canal and inner termination of cirrus-pouch.	Testes more median, situated dorsal to ovary, receptaculum seminis, and vitelline gland, and not extending outwards to longitudinal excretory canal.
(4) Ovary dorsal to receptaculum seminis, and consisting of a circle of "Indian club" shaped tubules opening into a common reservoir by slender necks.	Ovary on same plane as receptaculum seminis, nearer median field consisting of an irregular mass not showing tubular arrangement.
(5) Two uteri, whose origin is distinct as separate tubules, but which with increasing age approach each other and fuse in the median field.	Uterus originates as a single tube.

The only resemblance with *C. kurvaria* Shipley (7) is that the cirrus-pouch is much elongated and stretches over excretory vessels and nerve into the inner parenchyma. Also there is a large shell-gland in both species, and in ripe proglottides the uterus fills the whole of the inner parenchyma, not extending over the excretory canals and nerves but pushing these nearer the margin. The contrasts are well marked. In *C. kurvaria* the excretory system consists of extraordinarily wide channels, two large ventral and one smaller dorsal vessel, and the hind end of each proglottis shows a tongue-like projection of parenchyma into ventral vessel which lies on a projection of the wall of the latter and forms a barrier which prevents a backward flow of excretory fluid. No such structure is observed in *C. lagorchestis*.

Although the male organs are doubled the testes are not clearly divided into two groups. They are united in the median field of the proglottis. In *C. lagorchestis* there are two distinct groups lying in dorsal anterior field of segment, next to ventral excretory canal, and not spreading further towards median field than the inner border of the cirrus-pouch or the outer border of the receptaculum seminis. In *C. kuvaria* the ovary is ventral and the vitelline gland dorsal, while in *C. lagorchestis* the ovary is dorsal and the vitelline gland ventral. There is a single uterus, and the receptaculum is covered with a star-shaped epithelium in *C. kuvaria*. In *C. lagorchestis* the uterus is double, and there is no star-shaped epithelium covering the receptaculum seminis.

Text-figure 3.



Transverse section through a lateral portion of *Cittotænia quadrata* von Linstow, from (20) fig. 3, p. 680. *c*, cirrus; *n*, nerve; *g*, excretory vessels; *d*, vitelline gland; *s*, shell-gland; *v*, vagina; *r*, receptaculum seminis; *k*, ovary; *h*, testes.

C. quadrata von Linstow (20) shows very little resemblance with *C. lagorchestis*. There are two longitudinal excretory vessels, a larger ventral and a smaller dorsal, and a longitudinal nerve dorsal to these, as in *C. lagorchestis*. The chief points of contrast are that the vagina runs out and opens dorsal to the cirrus in *C. quadrata*; the receptaculum is small and dorsal to the ovary; the shell-gland is ventral to the vitelline gland, and the testes are dorsal to the ovary and extend in towards the median field. The eggs are four-sided and possess a pyriform body, and there is a single uterus.

C. pectinata Goeze (21 and 25) was examined at the British Museum (Natural History). The head is not sharply marked off from the strobila as in *C. lagorchestis*, nor are the suckers, which are set on the rounded anterior extremity, so large and prominent. The lateral margins of each segment are rounded and not

projecting as in *C. lagorchestis*. There is also a slight rostellate-like projection at the anterior end of the scolex. The posterior projecting border of each proglottis is smooth and only slightly overlaps the following segment, and the cirrus is never found protruding from the pore. There are secondary longitudinal canals uniting the transverse excretory canals. In the posterior proglottis the excretory canals open into a reservoir which opens at the excretory pore through many canals. The testes do not disappear, but are found in the posterior proglottis grouped round the excretory pore. There is an enlargement just inside the cirrus-pouch filled with sperm, the vesicula seminalis, and there are two seminal receptacles, a smaller external and a larger internal sac. There is a single uterus which extends over excretory canals and nerves into the lateral margins. The horns of the pyriform body are long and filamentous. The above points are in marked contrast with *C. lagorchestis*.

Cittotenia denticulata Rudolphi (25) was also examined at the British Museum (Natural History), and differs from *C. lagorchestis* chiefly in that the testes are in two groups in the lateral portion of the median field. The cirrus-pouch is short and does not reach the longitudinal nerve. There is a single uterus, and in ripe proglottides it extends over the longitudinal canals and nerves into the lateral margins.

These contrasts suffice to show that *C. lagorchestis* is a distinct species. It has been compared in the same way with all the described species mentioned in the Index Catalogue (27) and in the Zoological Record, and the disparity has been sufficient to indicate that it is a new species.

CITTOTENIA VILLOSA, sp. n. (Pls. V. fig. 16; VI. figs. 19, 20; VII.-X.)

These specimens have a leaf-like strobila and the shape resembles a large liver-fluke (fig. 16), being widest near centre and gradually tapering towards both extremities. The posterior proglottides become narrower but not longer, and thus differ from *C. pectinata* Goeze (21), in which species they also become longer. The length varies from 40-80 mm. and the greatest width is 6 mm. The number of proglottides in strobila vary from 120-200. The proportion of breadth to length in youngest proglottides is 1 : 3, in older 1 : 8. The scolex stands out from the anterior end of the strobila like a truncate cone (fig. 21). It is 8 mm. long by 6 mm. broad. The suckers are large and conspicuous and set on the widest part of the head. They are 3 mm. broad by 4 mm. long. There is no rostellum or hooks. In transverse section the head appears quadrate with rounded corners. The suckers occupy the four corners and nearly meet in the median line (fig. 19). In *C. lagorchestis* the head appears circular in transverse section (fig. 4). There is no neck, and the proglottides commence immediately behind the head.

In this species the posterior borders of the proglottides have a backwardly projecting sheath with more markedly fimbriated

posterior border than in *C. lagorchestis* (figs. 16, 22). The fimbriation is in the form of a regular serration in the earlier proglottides (fig. 21), only overlapping half the succeeding proglottis, but in older proglottides these fimbriations are much elongated to form a mass of elongate hair-like projections which cover two or three of the succeeding proglottides. These projections become more elongate towards the posterior end and project 4 or 5 mm. beyond the posterior segment (fig. 16). In no described *Cittotenia* is this sheath from the hind border of each proglottis broken up at its free edge in such a marked degree into hair-like lappets which project so far backwards over the succeeding proglottides.

Considerable difficulty was experienced in working out the internal structure of this species, because several of the strobilæ were mounted whole, and no trace of reproductive organs was observed in any of the proglottides (fig. 16). This was confirmed by series of sections throughout the strobila, which showed absence of reproductive organs (fig. 25). This was the more remarkable, in that the specimens without reproductive organs were not smaller in size, nor did they have fewer segments than those found with reproductive organs.

In the forms found with reproductive organs no trace of these was to be seen in the first 50 segments, after which an abrupt transition was met with and proglottides were found with reproductive organs. The reproductive organs reach maturity very rapidly, and very few segments contain them in a rudimentary state.

Again, after the 120th segment no reproductive organs were found. The segments with reproductive organs therefore were situated in the median portion of the strobila. This is in contrast with all other species of *Cittotenia*, where the first rudiments of the reproductive organs appear in the segments immediately behind the head.

The musculature is similar to that described for *C. variabilis* Stiles. The sub-cuticular layer, consisting of longitudinal and transverse layers, is especially well developed. The excretory system appears also to agree with the condition found in *C. variabilis*, but no reservoir was detected on the posterior proglottis, and the ventral canals discharge by a simple pore on the last proglottis, as in *C. lagorchestis*. The ventral canal is especially large and occupies a large part of the lateral field. One main longitudinal nerve trunk is present on each side dorsal to the two excretory vessels, but the details of the nervous system could not be determined in these specimens killed and fixed in alcohol.

Male Reproductive Organs.

There is only one testis-sac on each side, which is large, .4 mm. in diameter, and filled with a mass of developing sperm clusters (figs. 30 & 31). It is situated in the dorsal anterior field of each segment, a little nearer the median field than

the inner border of the receptaculum seminis. The vas deferens is coiled, and loops first towards the median field and then dorsally back towards the margin. A large part of the vas deferens is swollen to form an elongate vesicula seminalis as in *C. zschorkei* von Janicki (10). The vas deferens passes obliquely downwards to the cirrus-sac. The cirrus-pouch is even more elongate than in *C. lagorchestis*, 1·4 mm. long but not quite so broad. It is possessed of the same musculature on its wall as in *C. lagorchestis*, and the cirrus is also thick-walled with a muscular wall, a narrow lumen, and is covered with numerous bristles. Also, between the wall of the cirrus-sac and the cirrus is a mass of spongy tissue. In a few cases the cirri are seen protruding from the male genital pore (fig. 26), but in most cases cirrus and cirrus-sac are retracted from the margin and the muscular sphincter is retracted into the sub-cuticular parenchyma, and a wavy duct with wrinkled walls passes to the exterior to open at the anterior border of the lateral margin (figs. 23 & 24).

Female Reproductive Organs.

There is a large receptaculum seminis as in *C. lagorchestis*, and lying dorsal and to the inner side of this are a number of tubules, arranged fan-wise, which collect into a circular sac, alongside of which, nearer the median field, is a small bean-shaped vitelline gland. The duct from the receptaculum seminis enters the circular sac of the ovary. The oviduct passes out dorsally, and passes through the shell-gland near its origin from the ovary and enters the uterus dorsal to the ovarian tubules. The vagina is a thick-walled duct much as in *C. lagorchestis*, but is not abortive. It does not open into a genital atrium but opens separately in the middle of the projecting lateral margin of the segment (figs. 23 & 24). The uterus arises as a single transverse duct and has proximal and distal diverticula. It passes above the female genitalia on each side to run out over the longitudinal canals into the lateral margins as in *C. pectinata* Goeze (fig. 27). The egg has a pyriform apparatus, the horns of which are filamentous and cross one another (fig. 29).

The characters which show that this species is in distinct contrast to other species are:—

- (1) The extraordinary development of the fimbriations of the projecting sheath at the posterior border of each proglottis (fig. 16).
- (2) The presence of two large testicular sacs instead of, as in other species, numerous small testicular sacs (figs. 30 & 31).
- (3) The absence of reproductive organs entirely in some strobilæ (fig. 16).
- (4) The absence of reproductive organs in the earlier proglottides (fig. 25).
- (5) The male reproductive opening situated at the anterior edge of the projecting lateral margin and the female reproductive opening in centre of margin (figs. 23 & 24).

The species cannot be said to approach any of the described species closely, though possessing the general characteristics of the genus.

Of the works of reference the following list and also most of those given in the bibliography of (14) Johnston's "Entozoa of Monotremata and Australian Marsupials" were consulted.

For comparison of the above described species the following were found to be of most service:—7, 10, 11, 14, 15, 20, 21, 22, 23, 24, 25, 28, 29, 30, 31.

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EXPLANATION OF THE PLATES.

Lettering.

C.=Cirrus.
C.P.=Cirrus-pouch.
Ex.C.=Excretory canal.
G.A.=Genital atrium.
F.G.P.=Female genital pore.
M.G.P.=Male genital pore.
Ut.=Uterus.
R.S.=Receptaculum seminis.
Vag.=Vagina.
Sp.M.=Sphincter muscle.
Test.=Testes.
S.T.=Spongy tissue.
L.M.=Longitudinal muscle-layer.
Ov.T.=Ovarian tubules.
T.Ex.=Transverse excretory canal.
Sh.Gl.=Shell-gland.

Vit.Gl.=Vitelline gland.
Res.=Ovarian reservoir.
L.Ex.=Longitudinal excretory canal.
Ex.P.=Excretory pore.
M.L.=Muscular layers.
V.D.=Vas deferens.
Ves.Sem.=Vesicula seminalis.
L.L.=Lateral lappet.
Sk.=Suckers.
V.Ex.=Ventral excretory canal.
D.Ex.=Dorsal excretory canal.
N. or L.N.=Longitudinal nerve.
Ov.=Ovary.
F.Sh.=Fimbriated sheath.
C.M.=Circular muscle-layer.
Ov.R.=Rudiments of female glands.

PLATE I.

Cittotænia lagorchestis.

Fig. 1. Portion of strobila showing lateral projections of segment margins. The two uteri distinct in the earlier segments and meeting in median field in older proglottides. Scolex with suckers, and no rostellum.

- Fig. 2. Coronal section through head and first 25 segments, passing through suckers in head region.
3. Coronal section through middle of head between suckers showing origin of genital glands immediately behind head; first segments commencing immediately behind head. Large receptaculum seminis. Excretory ducts running up into head. Cirrus-pouch in some segments.
 4. Transverse section of head across suckers.

PLATE II.

Cittotænia lagorchestis.

- Fig. 5. Transverse section of very young proglottis showing vagina as a thick-walled duct below the cirrus-pouch.
6. Transverse section of an older proglottis showing vagina running out to open into genital atrium.
 7. Coronal section of a number of ripe proglottides.

PLATE III.

Cittotænia lagorchestis.

- Fig. 8. Transverse section showing transverse excretory canal connecting the larger ventral longitudinal canals.
9. Transverse section of proglottis, slightly older than in fig. 6, showing vagina which has lost its connection with the genital atrium and is becoming abortive.
 10. Coronal section showing ovarian tubules arranged in a circle and opening by narrow ducts into reservoir.

PLATE IV.

Cittotænia lagorchestis.

- Fig. 11. Enlargement of fig. 7, showing ovarian tubules, development of uteri, vitelline gland, shell-gland, testes, genital atrium, sphincter muscle, cirrus-pouch, cirrus, spongy tissue, receptaculum seminis, transverse and longitudinal excretory vessels, and longitudinal muscles.
12. Coronal section of a maturer portion of strobila showing uteri nearly meeting in median field. Disappearance of genital glands except cirrus-pouch and receptaculum seminis.
 13. Coronal section of tail end showing reproductive organs to within twelve segments of posterior end.

PLATE V.

[*Cittotænia lagorchestis.*]

- Fig. 14. Coronal section same as fig. 12, showing protruded cirri.
15. Coronal section of posterior end showing excretory pore.

Cittotænia villosa.

16. Strobila showing fimbriations and liver-fluke shape.

PLATE VI.

Cittotænia lagorchestis.

- Fig. 17. Longitudinal section in region of cirrus-sac showing testes and receptaculum seminis.
18. Transverse section of mature proglottis showing uteri nearly meeting in median field.

Cittotænia villosa.

19. Transverse section of head through suckers showing quadratic cross-section as contrasted with fig. 4.
20. Coronal section of head passing through suckers. Absence of neck and absence of reproductive organs; longitudinal excretory canals. Segmentation immediately behind head.

PLATE VII.

Cittotænia villosa.

- Fig. 21. Enlargement of head showing excretory canals running up into head suckers, and ornamented fimbriation.
 22. Whole mount of a portion of strobila enlarged showing hair-like projections.
 23. Coronal section showing male and female genital pores, uterus, cirrus, and vagina.

PLATE VIII.

Cittotænia villosa.

- Fig. 24. Coronal section showing uterus, vagina, cirrus-pouch, and cirrus.
 25. Transverse section through young proglottis. Well-developed subcuticular musculature, absence of reproductive organs.
 26. Transverse section showing protruded cirrus, sphincter muscle, cirrus-pouch, portion of vas deferens and of vesicula seminalis.

PLATE IX.

Cittotænia villosa.

- Fig. 27. Transverse section showing uterus in lateral margin.
 28. Transverse section showing the two large receptacula seminis.
 29. Egg with horns of pyriform body crossing.

PLATE X.

Cittotænia villosa.

- Fig. 30. Enlarged transverse section showing testis sac, part of coiled vas deferens and of vesicula seminalis, cirrus-pouch, and cirrus.
 31. Same series as fig. 30, showing the connection of vas deferens with cirrus-pouch.